Impacts of Low Stream flow and Elevated Water Temperature on Montana's Wild Trout Fishery

Montana Hydrology Workshop
July 27-29, 2010

Montana Fish, Wildlife & Parks

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Water Temperature Impacts

- Decreased O_2 concentrations with increasing water temperature.
- Increased metabolic rate –need more O_2.
- Lethal temperatures – too hot.
- Increased susceptibility to disease.
- Increased predation.

Water Temperature Limits

- Rainbow Trout Lethal Limit – 25°C to 27°C
- Brown Trout Lethal Limit – 27°C to 29°C
- Lower for native fish
  - Cutthroat -
  - Bull Trout -
  - Whitefish -
  - Arctic Grayling -

Low Streamflow Impacts

- Reduced pool and slow water habitat
  - Increased predation of smaller fish.
  - Increased stress due to attempted predation.
- Increased water temperature ??

Drought Fishing Restriction and Closure Rules - Cold Water Fisheries

- Max. daily water temperature meets or exceed 73°F (~23°C) for three consecutive days.
- Discharge falls to or below 5th percentile of daily mean value for period of record.
- Dissolved O_2 drops below 4 ppm.
- Bull trout streams - Max. daily water temperature meets or exceed 68°F ($_{20}$°C) for three consecutive days.

Reopening Criteria

- Reopen September 15 or Max. daily water temperature does not exceed 70°F (~21°C) for three consecutive days.

- Bull Trout - Max. daily water temperature does not exceed 60°F (~16°C) for three consecutive days and flow regime provides for adequate security habitat.

Drought Management Plans

- Drought management plans such as those adopted in the Big Hole, Jefferson and Blackfoot have specific fishing restriction and closure criteria that govern those water bodies.
- More restrictive that state-wide rules.

2007 Revisions

- No Voluntary Closures – Only Mandatory
- Time of Day Closure - 2 PM to Midnight
- Re-opening Criteria – prior to Sept. 15 three consecutive days when maximum water temp does not exceed 70º F

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Why limit fishing?

- Added stress of catch and release fishing increases mortality.
- Fish gill function decreases with increased water temperature further reducing ability to take in oxygen from water that is already becoming oxygen deficient.
- Excretion associated with being caught further reduced ability to absorb oxygen into the blood to due acidosis.

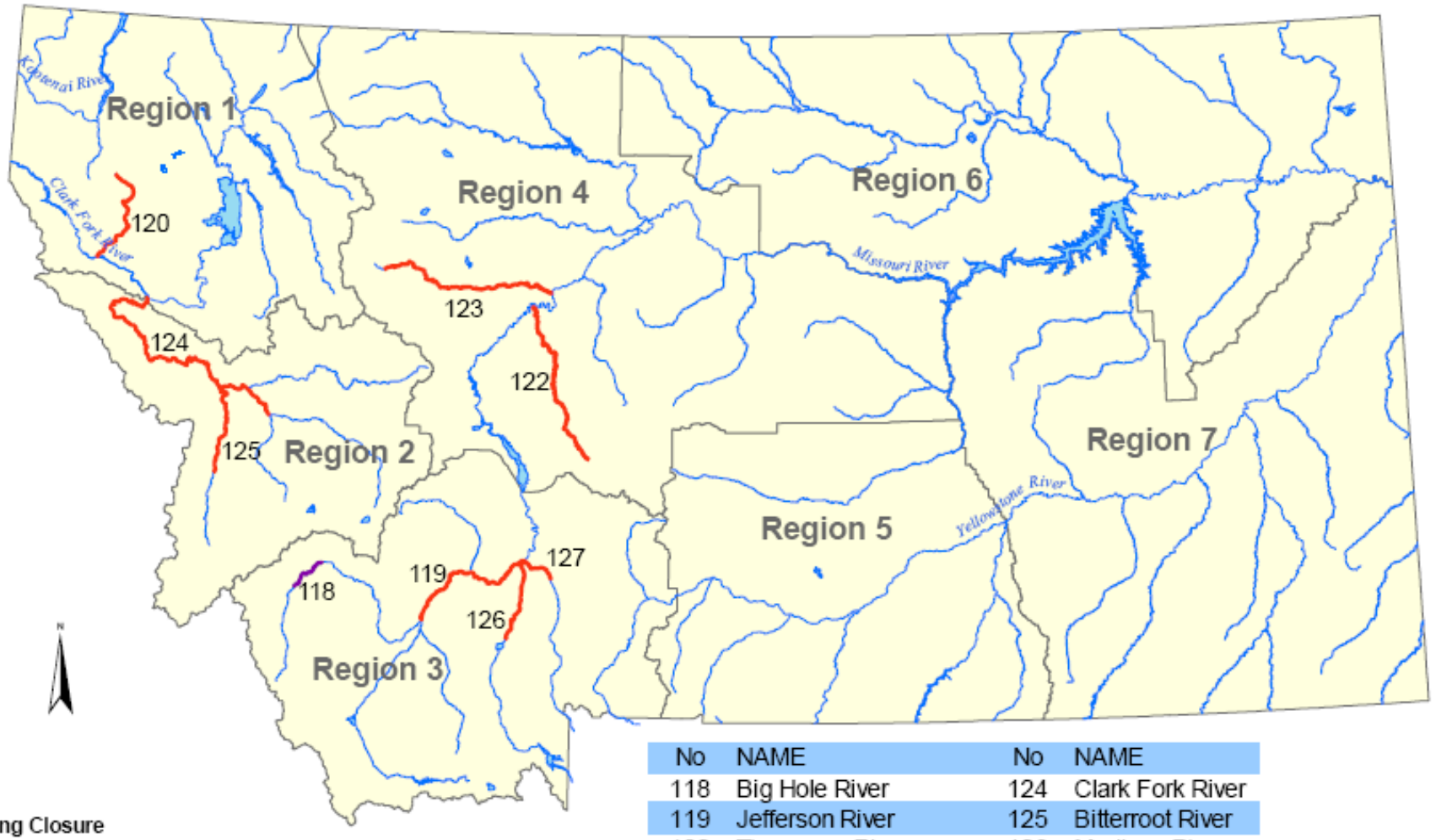
2008 Masters Thesis – Jim Boyd studied the effects of water temperature and catch and release angling on trout mortality.

- Gallatin River (2005-2007) & Smith River (2006-2007)
- Mortality of rainbows and whitefish increased when daily max. water temperature >20ºC.
  - Mortality higher in the evening than the morning.
- Mortality of brown trout increased when daily max. water temperature ≥23ºC.

Fishing Restrictions and Closures

as of July 13, 2007

Conditions can change rapidly. Be sure to check current drought information.



No	NAME	No	NAME
118	Big Hole River	124	Clark Fork River
119	Jefferson River	125	Bitterroot River
120	Thompson River	126	Madison River
122	Smith River	127	Gallatin River
123	Sun River		

Fishing Closure

- Mandatory Closure - 2 PM to Midnight
- Mandatory Closure - [24 hour]
- Streams
- FWP Region

0 10 20 40 60 80 Miles

Fishing Restrictions and Closures

as of August 14, 2007*

No	NAME	No	NAME	No	NAME	No	NAME
118	Big Hole River	127	Gallatin River	135	Shields River	144	Rattlesnake Creek
119	Jefferson River	128	Blackfoot River	136	East Gallatin River	145	Little Blackfoot River
120	Thompson River	129	Gold Creek	137	Morrell Creek	146	Fish Creek
122	Smith River	130	Belmont Creek	138	Landers Fork	147	Clark Fork River
123	Sun River	131	Cottonwood Creek	139	Yellowstone River	148	Rock Creek
124	Clark Fork River	132	Copper Creek	140	Boulder River	149	Seely Lake
125	Bitterroot River	133	Monture Creek	141	Stillwater River	150	Placid Lake
126	Madison River	134	North Fork Blackfoot R.	143	South Fork Flathead River		

Mandatory Closure - [24 hour]

Mandatory Closure - 2 PM to Midnight

Lake Mandatory Closure - 24 hours

Streams

FWP Region

*Map is updated as new closures are posted.
Refer to http://fwp.mt.gov/fishing/guide/waterclosure.aspx for a current list of all active closures.
Rev.14

0 12.5 25 50 75 100 Miles

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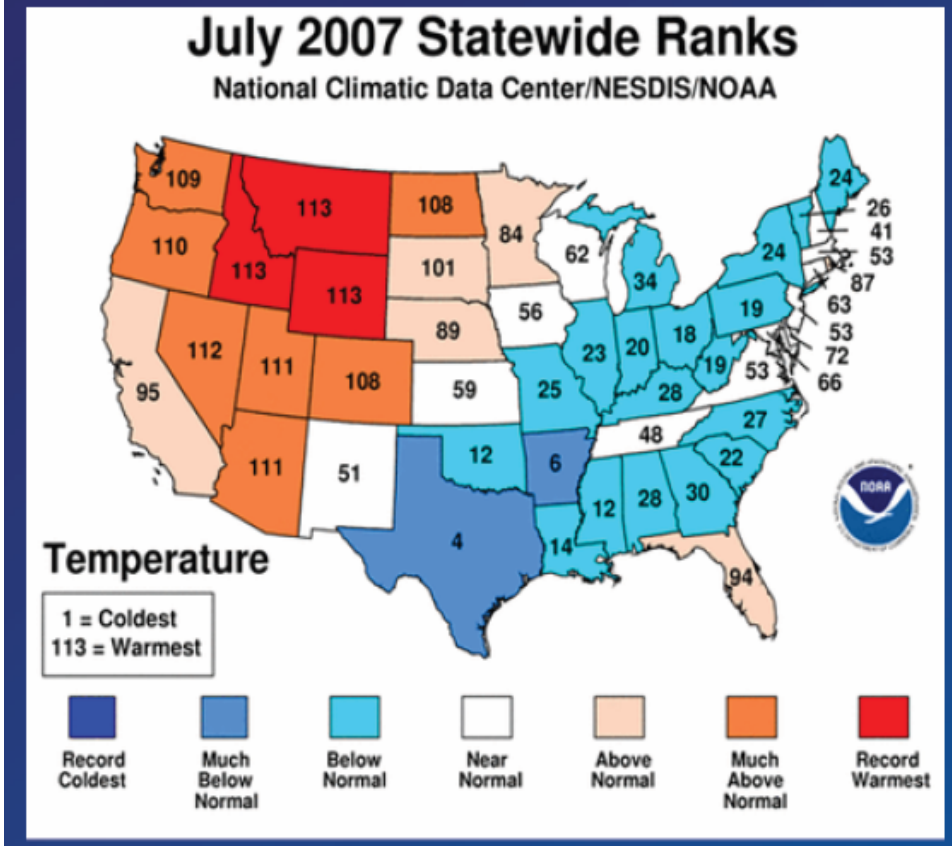
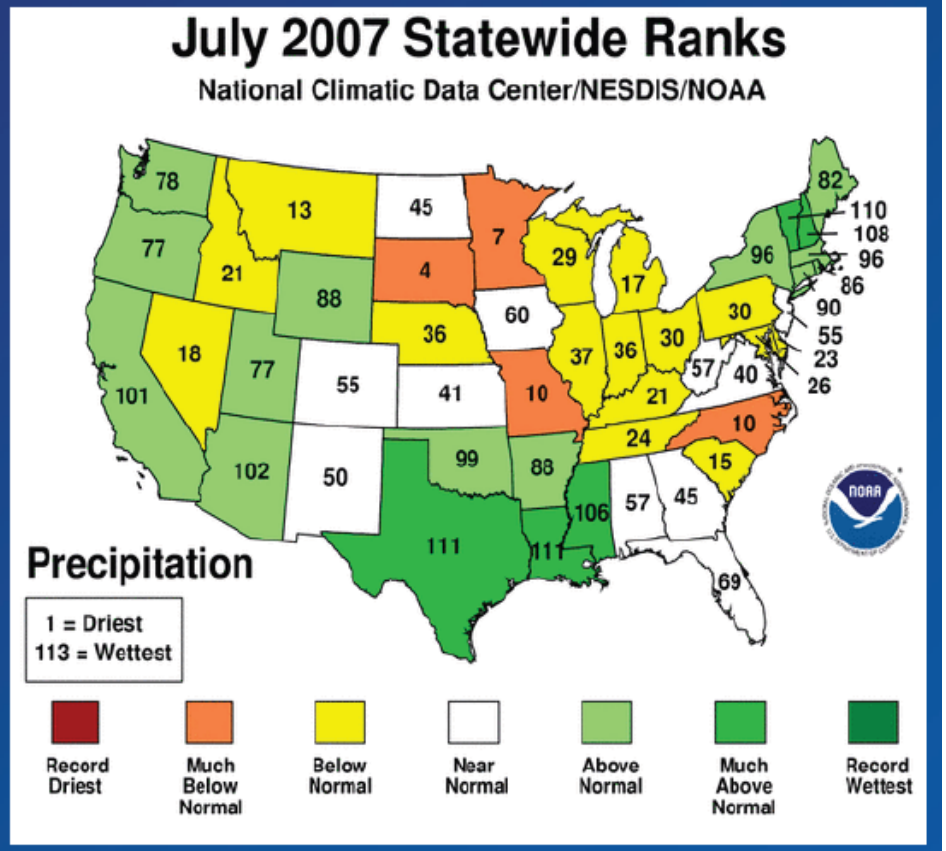
Temp and Precip Ranks by State

July 2007

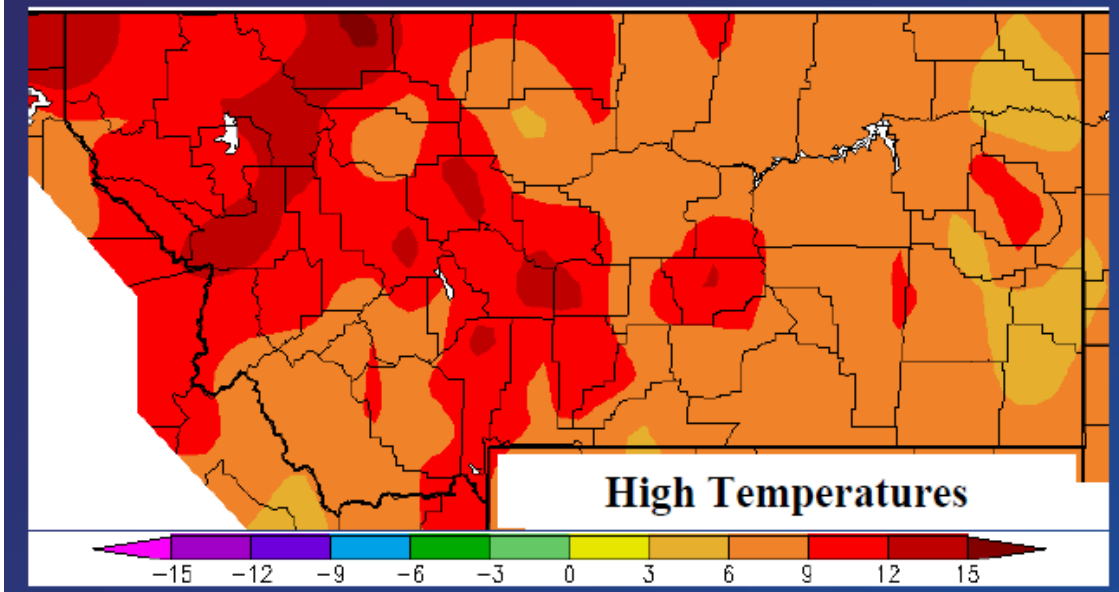


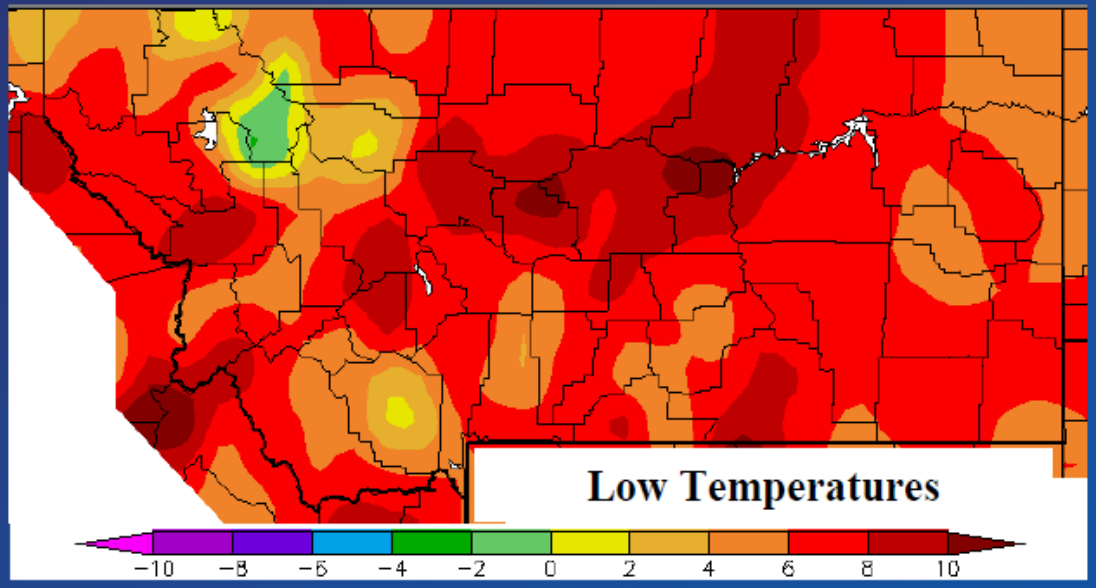


- The warmest of 113 years

- 13th driest of 113 years
- 13th driest only 'Below Normal'

Temperature Anomalies
July 2007





- Temperatures averaged above to much above normal
  - *Highs mostly 6 to 12 degrees above normal*
    - Some areas west 12 to 15 degrees above normal
  - *Lows mostly 4 to 10 degrees above normal*
- Wind
  - *Average - 7.2 mph*
    - 14 cities
  - *Normal - 8.6 mph*

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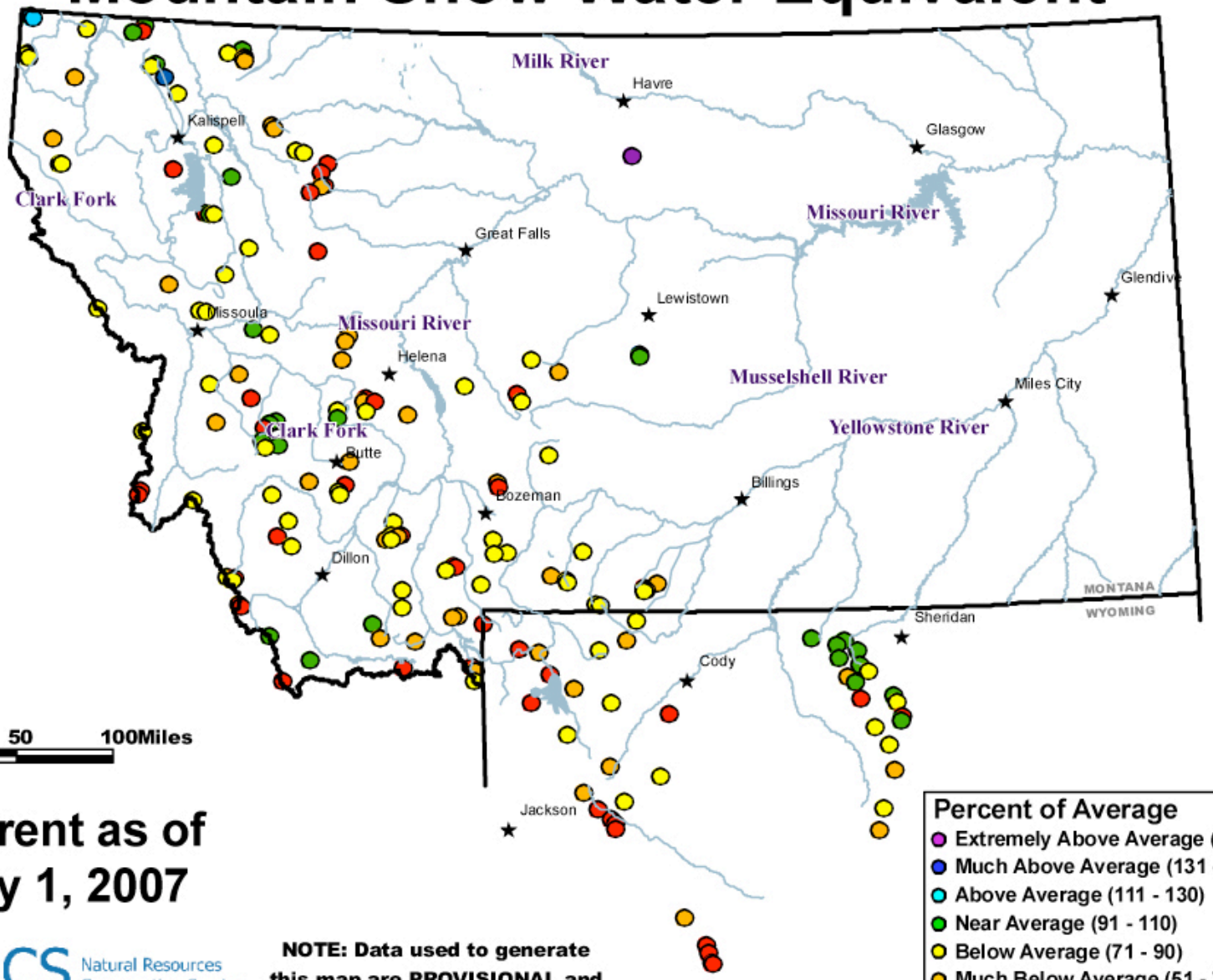
Mountain Snow Water Equivalent



Current as of May 1, 2007

NRCS Natural Resources Conservation Service

http://www.mt.nrcs.usda.gov

NOTE: Data used to generate this map are PROVISIONAL and SUBJECT TO CHANGE.

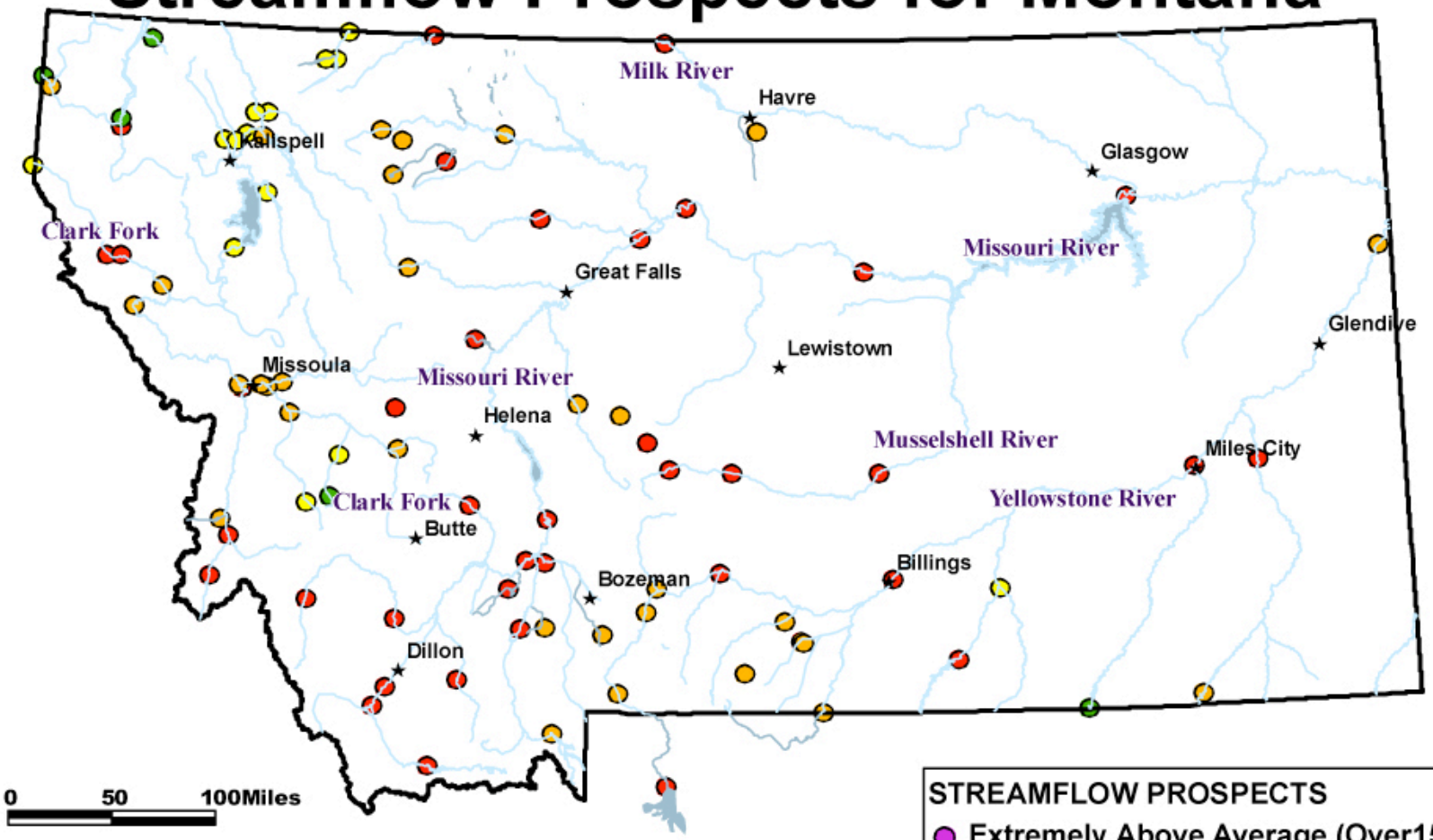
Percent of Average

- Extremely Above Average (Over150)
- Much Above Average (131 - 150)
- Above Average (111 - 130)
- Near Average (91 - 110)
- Below Average (71 - 90)
- Much Below Average (51 - 70)
- Extremely Below Average (Below 51)

UNITED STATES DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

Streamflow Prospects for Montana



STREAMFLOW PROSPECTS

- Extremely Above Average (Over150)
- Much Above Average (131 - 150)
- Above Average (111 - 130)
- Near Average (91 - 110)
- Below Average (71 - 90)
- Much Below Average (51 - 70)
- Extremely Below Average (Below 51)

Current as of June 1, 2007

NRCS Natural Resources Conservation Service

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- What is the relationship between summer discharge and water temperature in Montana's important wild trout fisheries?

- Hypothesis: Temperature is inversely related to discharge.